A BOTANICAL SYNOPSIS OF THE CULTIVATED CLOVERS (Trifolium)

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A Botanical Synopsis of the Cultivated Clovers (*Trifolium*)

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For many years the list of clovers cultivated for forage in the United States was restricted largely to such traditional standbys as white clover (*Trifolium repens*), alsike clover (*T. hybridum*), red clover (*T. pratense*), and crimson clover (*T. incarnatum*). However, foreign exploration by the Division of Plant Exploration and Introduction of the United States Department of Agriculture, and occasion-

ally other agencies, has resulted in introducing many additional species for trial. In fact, slightly more than 40 exotic clovers have already been extensively tested on an experimental scale in this country. Nearly half of these have demonstrated such desirable agronomic qualities that they are now being widely grown on a commercial basis and have apparently become a permanent part of our agricultural program.

Since these new clovers are still largely known to the layman only by name, the following key and detailed descriptions have been drawn up as an aid in distinguishing them from the better known species and from one another.

Species for which only an Old World range is given are not known in the United States except in cultivation.

There are numerous named agronomic varieties and strains of the cultivated clovers, particularly of red, white, crimson, subterranean, and strawberry clovers. No attempt is made to list these here, partly because the number is so large but particularly because most of the names are short-lived, owing to the constant development of new strains that rapidly displace earlier selections.

Key to Cultivated Clovers

a. Flowers yellow; pod distinctly stalked in the calyx.
  b. Heads 8 to 15 mm. thick, densely many-flowered; corolla conspicuously grooved and ridged in age.
    c. Terminal leaflet sessile; stipules, except on the lowermost leaves, equaling or longer than the petiole; style and mature pod about equal in length_____ 1. *T. agrarium.*
    c. Terminal leaflet stalked; stipules much shorter than the petiole; style one-fourth the length of the mature pod_____ 2. *T. campestre.*
  b. Heads 5 to 8 mm. thick, loosely 3- to 20-flowered; corolla scarcely grooved and ridged_____ 3. *T. dubium.*
a. Flowers red or pink to white or yellowish-white, but never clear-yellow; pod not stalked, or imperceptibly so.
  d. Calyx becoming greatly enlarged and inflated after flowering.
    e. Plant perennial, the stems reclining and rooting toward the base; involucre large, half the length of the calyx or more, green, firm; flowers not twisted_ 4. *T. fragiferum.*

e. Plant annual, the stems not rooting; involucre minute, thin, and translucent; flowers becoming twisted on the pedicels to an upside-down position or partly so.

f. Peduncles shorter than the leaves; fruiting heads woolly; fruiting calyx almost spherical, with scarcely thickened nerves, its upper lip terminated by 2 short teeth generally concealed in the wool; fruiting head not burlike---------- 5. *T. tomentosum.*

f. Peduncles, except the uppermost, longer than the leaves; fruiting heads hairy; fruiting calyx ovoid, with prominently thickened nerves, its upper lip terminated by 2 prolonged, conspicuous teeth; fruiting head burlike---------- 6. *T. resupinatum.*

d. Calyx not becoming enlarged or inflated, or only slightly so, after flowering.

g. Calyx glabrous (or, in *T. ambiguum*, with a few long hairs at the base of the teeth); flowers subtended by bracts that are minute except in *T. ambiguum.*

h. Plants perennial, turf-forming.

i. Pedicels equaling or longer than the calyx, glabrous or sparsely puberulent; calyx teeth erect; heads spherical or hemispherical.

j. Stems erect or ascending, without basal runners; peduncles not arising from prostrate stems; calyx teeth exceeding the tube, slender, their nerves more conspicuous than those of the sinuses; stipules gradually long-acuminate-- 7. *T. hybridum.*

j. Stems widely creeping or with long basal runners; peduncles arising from prostrate stems; calyx teeth equaling or shorter than the tube, their nerves not more conspicuous than those of the sinuses; stipules truncate or obtuse, mucronate. 8. *T. repens.*

i. Pedicels much shorter than the calyx, sparsely pilose; calyx teeth reflexed in fruit; mature heads oblong---------- 9. *T. ambiguum.*

h. Plants annual, not turf-forming.

k. Flowers 7 to 10 mm. long, in loose, long-peduncled heads; pedicels equaling the calyx tube; corolla white, 2 to 3 times the length of the calyx. 10. *T. nigrescens.*

k. Flowers 5 mm. long, in dense, sessile heads; pedicels rudimentary; corolla rose-colored, little exceeding the calyx---------- 11. *T. glomeratum.*

g. Calyx hairy or at least the teeth ciliate: flowers lacking bracts, except in *T. alexandrinum*, where they are early caducous.

l. Perfect flowers 2 to 5, reflexed after fertilization and concealed by a burlike husk of apetalous tentacle-like, sterile flowers; heads on axillary peduncles that soon become recurved and finally buried in the soil. 12. *T. subterraneum.*

l. Perfect flowers numerous, in terminal (sometimes also axillary) heads; specialized sterile flowers absent; peduncles not recurved.

m. Plants perennial, turf-forming, with stout horizontal or woody vertical rootstocks.

n. Free part of stipules subulate; leaflets elliptic; rootstocks horizontal; pod splitting lengthwise ---------- 13. *T. medium.*

n. Free part of stipules triangular, abruptly awned; leaflets obovate to broadly elliptic; rootstocks vertical; pod splitting by a transverse circular line of division---------- 14. *T. pratense.*

m. Plants annual, not turf-forming, with slender roots.

o. Flowers in axillary and terminal sessile heads---------- 15. *T. striatum.*

o. Flowers in axillary, peduncled heads, or all the heads terminal.

p. Heads cylindrical, oblong or ovoid-conical; calyx tube with only strong tooth- and sinus-nerves.

q. Corolla shorter than the calyx; leaflets linear-lanceolate to narrowly elliptic or narrowly oblanceolate----------16. *T. arvense.*

q. Corolla 2 to 3 times as long as the calyx; leaflets broader.

r. Free part of stipules long-pointed; calyx with teeth 3-nerved at the base, its tube 2 to 3 mm. long in fruit; leaflets broadly elliptic to oblanceolate, obtuse; corolla yellowish ---------- 17. *T. alexandrinum.*

r. Free part of stipules broad, obtuse or rounded; calyx with teeth 1-nerved, its tube 4 to 6 mm. long in fruit; leaflets broadly obovate, usually notched at the tip; corolla usually scarlet or deep-red---------- 18. *T. incarnatum.*

p. Heads spherical or short-ovoid; calyx tube with strong tooth-, sinus-, and intermediate-nerves.

s. Heads sessile, enclosed at the base by the stipules of the uppermost leaves; calyx tube densely hairy outside; teeth of fruiting calyx erect, little if at all broadened at the base---------- 19. *T. hirtum.*

s. Heads conspicuously peduncled at maturity, not enclosed by the stipules of the upper leaves; calyx tube glabrous outside; teeth of fruiting calyx spreading or reflexed, conspicuously broadened at the base.

20. *T. lappaceum.*

FIGURE 1.—Hop clover (*Trifolium agrarium*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

1. **Trifolium agrarium** L. HOP CLOVER (YELLOW CLOVER). (Fig. 1.)

Trifolium agrarium L., Sp. Pl. 772, 1753; em. Schreb. *in* Sturm, Deutschl. Fl. 1804.

T. strepens Crantz, Stirp. Austr., ed. 2, fasc. 5: 411. 1769.

T. aureum Poll., Hist. Pl. Palat. 2: 344. 1777.

T. campestre Gmel., Fl. Bad. 3: 237. 1808. Not Schreb. 1804.

T. fuscum Desv., Ann. Sc. Nat., ser. 1, 13: 330. 1828.

More or less appressed-pubescent annual or biennial, 1.5 to 4.5 dm. high; stems ascending to stiffly erect, usually branching; leaves short-petioled; leaflets oblong-obovate, the upper half or more of the margin toothed, the apex rounded to truncate or somewhat emarginate, all sessile or subsessile; stipules oblong-lanceolate, not dilated at the base, those of the upper leaves equaling or exceeding the petiole, united with the petiole for half their length; peduncle stout, stiff, straight, usually longer than the subtending leaves; heads dense, many-flowered, cylindric-ovoid, 1 to 2 cm. long, 1 to 1.5 cm. thick; pedicels shorter than the calyx tube; flowers golden-yellow, drying light-brown, becoming reflexed; calyx teeth very unequal, the lower longer than the tube; standard sulcate-striate when dry, 2 to 3 times the length of the calyx; wings spreading; style and mature pod subequal; seeds ovoid with oblique hilum, faintly greenish toward the base.

Europe, eastward to the Caucasus and Asia Minor.

Naturalized in North America along roadsides, in dry fields, and in waste places.

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FIGURE 2.—Low hop clover (*Trifolium campestre*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

2. **Trifolium campestre** Schreb.

LOW HOP CLOVER (LARGE HOP CLOVER). (Fig. 2.)

Trifolium campestre Schreb., *in* Sturm, Deutschl. Fl., heft 16, *pl. 13*. 1804.

T. agrarium L., Fl. Suec., ed. 2, 261. 1755. Not Sp. Pl. 1753.

T. procumbens L., Fl. Suec., ed. 2, 261. 1755; American authors. Not. Sp. Pl. 1753.

Sparingly appressed-pubescent to glabrate annual or biennial, 0.7 to 3 dm. high; stems often procumbent, or ascending to erect, usually branching; leaves short-petioled; leaflets cuneate-obovate, toothed above the middle, the apex truncate or rounded to shallowly emarginate, the terminal distinctly petiolulate, the lateral sessile or subsessile; stipules ovate, dilated and rounded at the base, those of the upper leaves much shorter than the petiole; peduncles stout, stiff, straight, often shorter than the subtending leaves; heads many-flowered, hemispherical, becoming ovoid, 0.5 to 1.5 cm. long, 0.8 to 1.2 cm. thick; pedicels shorter than to slightly exceeding the calyx tube; flowers yellow, becoming brownish-yellow and reflexed; calyx teeth unequal, the lower longer than the tube; standard becoming strongly striate, 2 to 3 times the length of the calyx; style much shorter than the mature pod; seeds narrowly ellipsoid.

Europe, northern Africa, and western Asia.

Naturalized in North America along roadsides, in old fields, and in waste places.

Most American authors still treat this species under the name *Trifolium procumbens,* but it is not *T. procumbens* L. of the first edition of the *Species Plantarum,* which is largely *T. dubium.* The application of the name has been so badly muddled throughout its long career that it probably had best be dropped as a nomen confusum. In the eighth edition of Gray's "Manual of Botany" (1950), Fernald (*p. 894*) maintains *T. procumbens,* based on the argu-

FIGURE 3.—Small hop clover (*Trifolium dubium*).
(From Javorka and Csapody, Inconographia Florae Hungaricae.)

ment that the "technical characters and specific names of [*Trifolium agrarium, T. procumbens,* and *T. dubium*] are very differently interpreted but not uniformly agreed upon by some recent European students. Until they reach agreement the long-established names are retained." Actually, however, there appears to be no considerable disagreement among European botanists as to the interpretation of the technical characters or the application of the names of the three species, except that a few authors favor substituting the ambiguous *T. procumbens* for the clearly defined *T. dubium.*

3. **Trifolium dubium** Sibth.

SMALL HOP CLOVER (LEAST HOP CLOVER). (Fig. 3.)

Trifolium dubium Sibth., Fl. Oxon. 231. 1794.

T. procumbens L., Sp. Pl. 727. 1753, in large part.
T. filiforme L., Fl. Suec., ed. 2, 261. 1755. Not Sp. Pl. 1753.
T. minus Sm., *in* Relhan, Fl. Cantabr., ed. 2, 290. 1802.

Glabrate annual or biennial, generally with scattered hairs above; stems rather slender, 0.5 to 3 dm. long, procumbent, ascending, or (when crowded) erect, usually branching or occasionally simple; leaves short-petioled; leaflets narrowly cuneate-obovate, toothed above the middle, emarginate to truncate or rounded at the apex, the terminal having a conspicuously longer petiolule than the lateral; stipules small, obliquely ovate, acute, broadly rounded at the base, shorter than the petiole (except those of the uppermost leaves); peduncles filiform, straight, generally exceeding the subtended leaves; heads lax, hemispherical to spherical, small, 5 to 8 mm. thick; pedicels shorter than the calyx tube; flowers bright-yellow, becoming brown-opaque and reflexed in age; calyx teeth very unequal, the lower scarcely as long as the tube; standard scarcely or not at all striate in age, twice the

FIGURE 4.—Strawberry clover (*Trifolium fragiferum*).
(From Nevada University Agricultural Extension Service Bulletin 89.)

length of the calyx or more; wings not spreading; style much shorter than the mature pod; seeds ovoid, glossy, the hilum nearly flush with the margin.

Europe, eastward to the Caucasus.

Naturalized in North America along dry roadsides, in waste places, and in old fields.

4. **Trifolium fragiferum** L. STRAWBERRY CLOVER. (Fig. 4.)

Trifolium fragiferum L., Sp. Pl. 772. 1753.

T. ampullescens Gilib., Fl. Lithuan. 4: 89. 1781.

T. neglectum Fisch., Mey., & Ave-Lall., Ind. Sem. Hort. Petrop. 9, Suppl. 21. 1842.

T. congestum Link, Linnaea 9: 584. 1835. Not Guss. 1821.

More or less pubescent perennial; stems repent, branching, 1 to 3 dm. long, rooting at the nodes; petioles long, pilose; leaflets broadly elliptic to narrowly obovate, obtuse or emarginate, often mucronate, 5 to 15 mm. long, 4 to 12 mm. wide, minutely toothed, glabrous, the nerves parallel, thickened and conspicuous at the margin; stipules lanceolate-acuminate, dilated and white-chartaceous toward the base; peduncles scapose, pilose, usually curved-ascending and exceeding the subtending leaves; heads densely many-flowered, ovate to globose, becoming 1.2 to 2 cm. thick in fruit; involucre composed of lanceolate, often irregularly divided, bracts about equaling the calyx; flowers crowded, subsessile, the outer subtended by bracteoles as long as the calyx; calyx bilabiate, the upper side villous, becoming greatly inflated and coarsely reticulate in fruit, the spreading upper teeth shorter than the tube, projecting from the fruiting head as rigid bristles, the approximate lower teeth equaling the tube; corolla roseate, longer than the calyx; standard about 6 mm. long, strongly nerved; pod obliquely ovate, acute, included; seeds ovoid-truncate, spotted with light brown.

FIGURE 5.—Woolly clover (*Trifolium tomentosum*).
(From Fiori, Iconographia Florae Italicae.)

Throughout most of Europe, to Turkistan, Iran, and northern Africa.

In North America, occasionally a weed in lawns (Tompkins County, N. Y.).

5. **Trifolium tomentosum** L. WOOLLY CLOVER. (Fig. 5.)

Trifolium tomentosum L., Sp. Pl. 771. 1753.

T. bullatum Boiss., Fl. Orient. 2: 138. 1872.

Glabrous annual or biennial; stems decumbent, 0.5 to 2.5 dm. long, not rooting at the nodes; leaves long-petioled; leaflets cuneate-obovate, truncate to obtuse, finely nerved, the upper half toothed; stipules ovate, much shorter than the petiole, dilated and rounded at the base, rather abruptly tapering into a prolonged acuminate tip; peduncles axillary, much shorter than the leaves; heads becoming globose, about 1 cm. in diameter in fruit; involucre composed of greatly reduced, inconspicuous hyaline bracts; flowers very small, 3 to 4 mm. long, sessile, semiresupinate; calyx bilabiate, the upper lip globose-inflated in fruit, tomentose, the 2 short teeth becoming reflexed and hidden in the tomentum; corolla roseate; pod ovate, subacute, included; seeds ovoid to ellipsoid-ovoid, yellow to brown, sometimes mottled, lustrous, cotyledon margins visible.

Sterile habitats, chiefly near the coast of the Mediterranean, eastward to Transcaucasia and Iran.

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FIGURE 6.—Persian clover (*Trifolium resupinatum*).
(From Fiori, Iconographia Florae Italicae.)

6. **Trifolium resupinatum** L. PERSIAN CLOVER. (Fig. 6.)

Trifolium resupinatum L., Sp. Pl. 771. 1753.

T. bicorne Forsk., Fl. Aegypt.-Arab. 139. 1775.
T. suaveolens Willd., Enum. Hort. Berol. 1: 108. 1809.
T. clusii Gren. & Godr., Fl. France 1: 414. 1848.

Glabrous, often coarse, annual or biennial; stems ascending, diffuse, or decumbent, 1 to 4 dm. long, branching; lower and middle leaves long-petioled, the uppermost subsessile; leaflets cuneate-ovate to cuneate-obovate, acute to obtuse or truncate, denticulate, strongly nerved beneath; stipules lanceolate, long-acuminate, the base chartaceous-dilated; upper peduncles mostly equaling or shorter than the leaves, the lower considerably longer; heads soon becoming globose, 1.5 to 2 cm. in diameter in fruit; bracts minute, membranaceous, truncate, forming a very short, toothed and often divided, involucre; flowers small, 5 to 6 mm. long, subsessile, resupinate; calyx bilabiate, the upper lip inflated in fruit, ovoid-conic, coarsely reticulate, pilose, terminated by 2 bristle-like, divaricate teeth; corolla roseate to purplish, 2 to 3 times the length of the calyx; pod orbicular to ovate, included; seeds ovoid-truncate, greenish-brown to greenish-black, lustrous.

Southern Europe, northern Africa, eastward to Transcaucasia and Iran.

Locally adventive in North America in lawns, in fields, and along roadsides, from Massachusetts to Illinois, southward to Alabama, and westward to eastern Kansas.

FIGURE 7.—Alsike clover (*Trifolium hybridum*).
(From Nevada University Agricultural Extension Service Bulletin 89.)

7. **Trifolium hybridum** L. ALSIKE CLOVER

(Fig. 7.)

Trifolium hybridium L., Sp. Pl. 766. 1753.

T. fistulosum Gilib., Fl. Lithuan. 4: 87. 1781.

T. michelianum Gaud., Fl. Helv. 4: 573. 1829. Not Savi. 1798.

Glabrous, short-crowned, perennial; stems firm, usually hollow, erect or ascending from a procumbent base, 2 to 8 dm. long, sometimes branching; leaves, except the uppermost, long-petioled; leaflets ovate or oval to cuneate-obovate, obtuse to emarginate, 1 to 6 cm. long, 1 to 3 cm. wide, dull-green, finely setose-toothed, many-nerved; stipules broadly oblong-lanceolate, the tip usually long-attenuate; peduncles axillary, longer than the leaves; heads globose, becoming semiglobose, dense, 30- to 50-flowered, 2 to 3.5 cm. in diameter; bracts subulate, much shorter than the pedicels; pedicels unequal, those of the inner flowers becoming twice the length of the calyx tube; flowers 6 to 11 mm. long, becoming reflexed in age; calyx about equaling the pedicels of the outer flowers, 3 to 4.5 mm. long, the upper teeth slightly longer than the lower and somewhat exceeding the campanulate tube; corolla pink and white or roseate, becoming dull-brown; pod stipitate, 2- to 4-seeded; seeds ovoid-truncate, dull-green to nearly black.

Central Europe and Asia Minor.

Much cultivated in North America, spreading to roadsides and clearings from Newfoundland to British Columbia and southward to northern United States.

7a. **Trifolium hybridum** var. **pratense** Rabenh.

Trifolium hybridum var. *pratense* Rabenh., Fl. Lusat. 1: 198. 1839.

T. elegans Savi, Fl. Pis. 2: 161. 1778.

T. hybridum var. *elegans* (Savi) Boiss., Fl. Orient. 2: 146. 1872; Garcke, Fl. Deutschl., ed. 15, 102. 1885.

FIGURE 8.—White clover (*Trifolium repens*).
(From Nevada University Agricultural Extension Service Bulletin 89.)

Smaller and more slender than typical *T. hybridum* L., 1 to 5 dm. high; leaflets 1 to 3.2 cm. long, 0.7 to 2.5 cm. wide; heads about 30-flowered, 1.25 to 2.5 cm. in diameter; flowers 5 to 7 mm. long.

The more commonly naturalized form in North America found in fields, in clearings, and along roadsides.

8. **Trifolium repens** L. WHITE CLOVER. (Fig. 8.)

Trifolium repens L., Sp. Pl. 767. 1753.

T. nigrescens Schur, Enum. Pl. Transsilv. 157. 1866.

Glabrous perennial; stems solid, creeping, 1 to 4 dm. long, rooting at the nodes; leaves long-petioled; leaflets cuneate-obovate to broadly oblong, emarginate or obtuse, 1 to 3 cm. long, 0.75 to 2.5 cm. wide, dull-green or occasionally white-marbled, denticulate; stipules pale except for the conspicuous nerves, abruptly narrowed to a point; peduncles scapiform, usually very elongate; heads subglobose, becoming semiglobose in fruit, rather loose, 20- to 40-flowered, 1.5 to 2 cm. in diameter; bracts membranaceous, at first equaling the pedicels but much exceeded by them as the latter elongate; pedicels often sparsely puberulent, elongating and recurving in age, the inner longer than the outer; flowers 6 to 10 mm. long, fragrant; calyx teeth unequal, the upper slightly shorter than the tube, the lower two-thirds its length; corolla white or rose-tinged, becoming brown, 8 mm. long, twice the length of the calyx; pod sessile, linear, exserted, 3- to 4-seeded; seeds ovoid-truncate, usually entirely yellowish.

Europe and Asia Minor, eastward to Turkestan and Siberia.

Naturalized in North America in meadows, in open woods, and along roadsides.

FIGURE 9.—Kura clover (*Trifolium ambiguum*).

8a. **Trifolium repens** f. **giganteum** Lagr.-Foss.

LADINO CLOVER.

Trifolium repens f. *giganteum* Lagr.-Foss., Fl. Tarn-et-Garonne 95. 1847.

Larger than the typical form, the stems fistulose, petioles up to 6 dm. long; leaflets usually 4 to 5 times larger than in the typical form; heads 3 cm. in diameter; flowers about 1 cm. long.

Innumerable agronomic strains of white clover have received names in the trade. They are grouped as large, intermediate, and small, according to the size of the plant.

9. **Trifolium ambiguum** M. Bieb.

KURA CLOVER (CAUCASIAN CLOVER). (Fig. 9.)

Trifolium ambiguum M. Bieb., Fl. Taur.-Cauc. 2: 208. 1808.

T. vaillantii M. Bieb. ex Fisch., Cat. Gorenk. 111. 1808, name only; ex Boiss., Fl. Orient. 2: 147. 1872.

Stout perennial; stems creeping, ascending, 1 to 4 dm. long, glabrate or sparingly pubescent above; leaves all petiolate; leaflets broadly elliptic to elliptic-lanceolate, obtuse to shallowly emarginate, 1 to 8 cm. long, 0.5 to 5 cm. wide, setose-toothed; stipules pale, marcescent, ovate, acuminate; peduncles moderately long, occasionally very long; heads lateral and terminal, subglobose or ovate, becoming oblong in fruit; bracts linear-lanceolate, much exceeding the pedicels, membranous with a prominent excurrent midrib; pedicels one-fourth to one-half the length of the calyx tube, sparingly pilose, reflexed in fruit; flowers 10 to 12 mm. long; calyx glabrous except for the sparsely hairy base and rim of the tube, the tube often more or less plicate between the nerves, 3 mm. long, the teeth lanceolate-subulate with membranous margins, widely spreading to reflexed in fruit, subequal, 2.5 to 3

FIGURE 10.—Ball clover (*Trifolium nigrescens*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

mm. long; corolla white, becoming reddish in age, about twice the length of the calyx; pod oblong, glabrous, mostly 2-seeded; seeds reniform, dull-yellowish or reddish-brown.

Southern Russia; Crimea; the Caucasus; Asia Minor.

10. **Trifolium nigrescens** Viv. BALL CLOVER. (Fig. 10.)

Trifolium nigrescens Viv., Fl. Ital. Fragm. 12, *pl. 13.* 1808.

Glabrous annual, usually branching from the base; stems decumbent to ascending, 1 to 5 dm. long, not rooting at the nodes; petioles of the lower leaves exceeding the leaflets, those of the uppermost much shorter; leaflets obovate from a cuneate base, truncate to emarginate, 10 to 30 mm. long, 7 to 30 mm. wide, sharply setose-toothed above, entire near the base, prominently nerved; stipules membranous, triangular-lanceolate, abruptly acuminate to a setose tip; peduncles axillary, exceeding the leaves; heads many but loosely flowered, globose to semiglobose, 12 to 20 mm. in diameter; bracts small, triangular-subulate, strongly keeled; pedicels in anthesis equaling the calyx tube, the inner greatly elongating in fruit; flowers 7 to 10 mm. long, fragrant, white to yellowish-white, becoming sordid-yellow and strongly reflexed on drying; calyx glabrous, 5-ribbed with prominent intermediate nerves, somewhat 2-lipped, the teeth triangular-lanceolate, recurved after anthesis, unequal, the upper approximate, longer than the lower and about equaling the tube; corolla 5 to 8 mm. long, 2 to almost 3 times the length of the calyx; pod linear, exserted, 3- to 4-seeded; seeds ovoid, dark-brown.

Southern Europe and the Mediterranean region to the Caucasus.

FIGURE 11.—Cluster clover (*Trifolium glomeratum*).
(From Fiori, Iconographia Florae Italicae.)

11. **Trifolium glomeratum** L. CLUSTER CLOVER. (Fig. 11.)

Trifolium glomeratum L., Sp. Pl. 770. 1753.

Glabrous annual; stems usually slender, procumbent or ascending from a procumbent base, rarely erect, branching, 1 to 3 dm. long; lower leaves alternate, long-petioled, the uppermost opposite, on very short petioles; leaflets obovate from a cuneate base, truncate and broadly emarginate to obtuse and mucronate, mostly 5 to 10 (rarely 17) mm. long and 3 to 10 (rarely 14) mm. wide, strongly nerved, setose-toothed above, often nearly to the base; stipules translucent-membranous, ovate, acuminate to a subulate tip; heads axillary, sessile, densely flowered, globose, small, mostly 5 to 9 mm. in diameter; bracts almost obsolete; pedicels minute; calyx strongly 10- to 12-nerved, the teeth triangular-ovate, aristate, subauriculate, spreading and soon becoming recurved, subequal, shorter than the tube; corolla rose-colored, about 4 mm. long, only slightly exceeding the calyx; standard oblong-ovate, plicate; pod obliquely mucronate, 1- to 2-seeded, included; seeds roundish to subreniform, minutely verrucose, dull-yellow.

Western and southern Europe eastward to the Caucasus and Asia Minor; Syria and northern Africa.

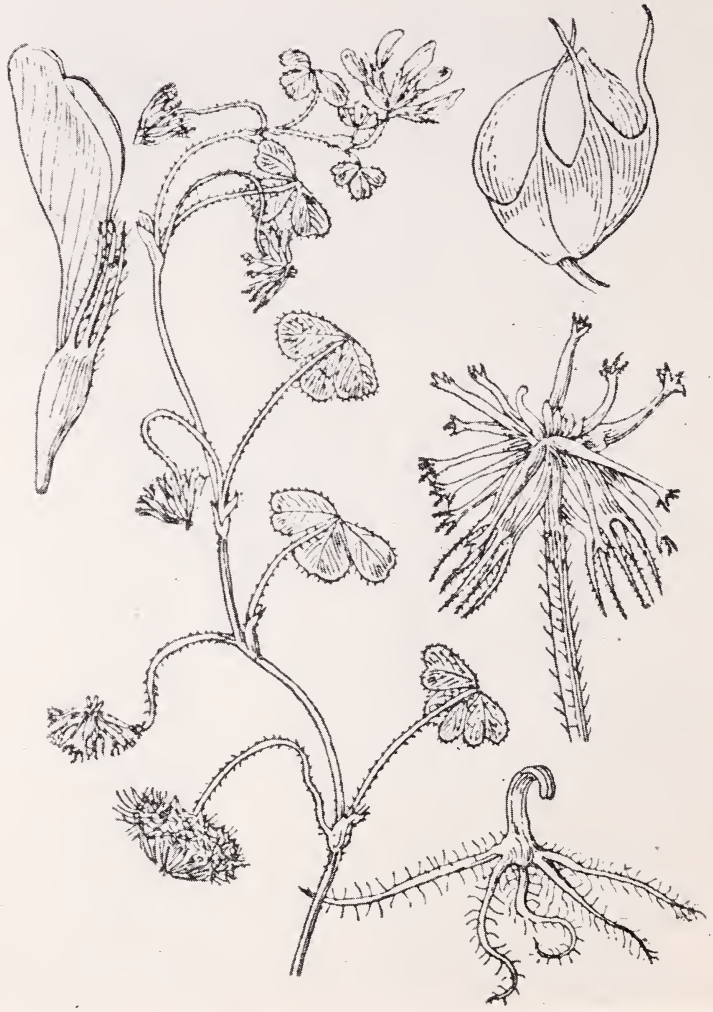

FIGURE 12.—Subterranean clover (*Trifolium subterraneum*). (From Fiori, Iconographia Florae Italicae.)

12. **Trifolium subterraneum** L. SUBTERRANEAN CLOVER. (Fig. 12.)

Trifolium subterraneum L., Sp. Pl. 767. 1753.

T. oxaloides Bunge ex Nyman, Consp. 177. 1878.

T. subterraneum var. *oxaloides* Rouy & Foucaud, Fl. France 5: 99. 1899.

More or less softly pubescent annual; stems slender, procumbent 0.5 to 4 (rarely 8) dm. long, forming circular clumps; leaves all long-petioled; leaflets broadly obcordate, entire except for the shallowly crenate apex; stipules ovate to oblong-ovate, the lowermost acuminate, otherwise acute to obtuse; peduncles axillary, reflexing, elongating and burying the heads in the soil after anthesis; inflorescence a few-flowered fascicle becoming a globose head in fruit; fertile flowers 2 to 5, whitish, striped with rose, 12 to 14 mm. long; sterile flowers developing after anthesis, numerous, apetalous, finally completely enclosing the pods; calyx of the fertile flowers nerveless, the tube glabrous, the subequal flexuous teeth ciliate, equaling the tube, at first setaceous, becoming stout; corolla about twice the length of the calyx; sterile flowers with calyx teeth rather unequal, narrow, irregularly bent, spreading, star-shaped; pod membranous, obovate, slightly exserted, 1-seeded; seed large, broadly ellipsoid, purplish-black.

Western and southern Europe and northern Africa to Iran and the Caucasus.

FIGURE 13.—Zigzag clover (*Trifolium medium*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

13. **Trifolium medium** Huds. ZIGZAG CLOVER. (Fig. 13.)

Trifolium medium L., Fauna Suec., ed. 2, 558. 1761, name only; Huds., Fl. Angl. 284. 1762.

T. flexuosum Jacq., Fl. Austr. 4: 45. 1776.

T. bithynicum Boiss., Diagn. Pl. Orient., ser. 1.9.21. 1848.

T. transsilvanicum Porc., Naseud. 205. 1881; ex Simonk., Enum. Fl. Transsilv. 179. 1886.

Sparingly strigose perennial, branching at the crown; stems flexuose, ascending, 3 to 4.5 dm. long; petioles mostly about the length of the leaflets; leaflets elliptic-oblong to oval, obtuse to acute, 1.5 to 5.5 cm. long, 0.6 to 1.5 cm. wide, almost entire, the margin finely ciliate; stipules pale, lanceolate, ciliate, the free part lanceolate-subulate, herbaceous, divergent, usually shorter than the petiole; peduncles at first very short, later usually more or less elongating; heads mostly terminal, solitary or occasionally paired, subglobose to ovoid, 2 to 4 cm. long; flowers 13 to 18 mm. long, light-purple, erect; calyx tube cylindrical, rounded at the base, glabrous or with a few hairs outside, but with a ring of stiff hairs at the inner margin of the throat, the teeth filiform from a triangular base, porrect, sparsely hispid, unequal, the lower about twice the length of the tube; corolla nearly twice as long as the calyx; pod ovoid to obovoid, opening by longitudinal valves; seeds triangular-ovoid, yellow to brown.

Central and southern Europe; western Asia.

Locally naturalized in North America in fields, on borders of woods, and on roadsides, from eastern Quebec and New Brunswick to Massachusetts.

The name "zigzag clover," which has been incorrectly applied to mammoth clover (*Trifolium pratense* var. *perenne* Host), should be restricted to *T. medium*.

FIGURE 14.—Red clover (*Trifolium pratense*).
(From United States Department of Agriculture Yearbook, Grass, 1948.)

14. **Trifolium pratense** L. RED CLOVER. (Fig. 14.)

Trifolium pratense L., Sp. Pl. 768. 1753.

T. expansum Waldst. & Kit., Pl. Rar. Hung. 3: 237. 1812.

T. nivale Sieb. ex Koch, Syn. Fl. Germ. 168. 1835.

T. alpicolum Hegetschw. & Heer, Fl. Schweiz 699. 1840.

T. brachystylos Knaf, Lotos 237. 1854.

T. silvestre Ducomm., Taschenb. 168. 1869.

T. carpaticum Porc., Naseud. 205. 1881.

Perennial, or sometimes biennial, sparingly pilose to glabrous or, in forma *pilosum* (Griseb.) Hayek, densely villous; stems erect or ascending, 1 to 5 dm. long; leaves of the basal rosette all long-petioled, those of the stem moderately long-petioled to nearly sessile; leaflets oval or elliptic to cuneate-obovate, 1 to 3 cm. long, 0.5 to 1.5 cm. wide, subentire; stipules oblong-oval to oval-triangular, the free part broadly triangular, abruptly tapering to an erect setaceous tip; peduncles short or absent; heads mostly terminal, sessile or short-peduncled, usually closely subtended by the stipules of the upper pair of leaves, dense, subglobose to ovoid, 1.2 to 3 cm. long; flowers sessile, 10 to 15 mm. long, rosy purple (creamy-white in forma *leuchochraceum* Aschers. & Prantl), erect; calyx tube campanulate, narrowed at the base, 10-nerved, pubescent (including the inner margin of the throat, many modern descriptions notwithstanding), the teeth filiform from a triangular base, sparsely hirsute, porrect, the upper about equaling the tube, the lower almost twice as long; corolla about twice the length of the calyx; pod oblong-ovoid, circumscissile; seeds ovoid, asymmetrical, yellowish to purplish.

Europe, western Asia, and North Africa.

Naturalized throughout North America, south of Labrador and British Columbia, along roadsides and in clearings.

FIGURE 15.—Knotted clover (*Trifolium striatum*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

14a. **Trifolium pratense** var. **sativum** Schreb.

CULTIVATED RED CLOVER.

Trifolium pratense var. *sativum* Schreb., *in* Sturm, Deutschl. Fl. heft 16, *pl. 12.* 1804.

T. pennsylvanicum Willd., Enum. Hort. Berol. 793. 1809.

T. sativum Crome in Bönningh., Prodr. Fl. Monast. 222. 1824.

T. boeticum Boiss., Voy. Esp. 726. 1839–45.

T. pratense var. *fistulosum* Schur, Enum. Pl. Transsilv. 154. 1866.

Coarser than the typical plants; stems 4 to 8 dm. long; larger leaflets 3 to 7 cm. long, 1.5 to 3.5 cm. wide; heads 3 to 4 cm. long; corolla roseate, or whitish in forma *flavicans* (Vis.) Hayek.

Commoner than the typical plant; extensively cultivated and naturalized throughout the range of the typical variety.

As with white clover, the number of agronomic strains developed from typical red clover is large and fluctuating. The most important and stable of them are the medium-red or double-cut and the mammoth-red or single-cut.

15. **Trifolium striatum** L. KNOTTED CLOVER.

(Fig. 15.)

Trifolium striatum L., Sp. Pl. 770. 1753.

T. incanum Pres., Delic. Prag. 1: 48. 1822.

T. tenuiflorum Ten., Fl. Nap. 5, *pl. 172.* 1835.

T. cylindricum Wallr., Beitr. Fl. Hercyn. 249. 1840.

Villous annual; stems depressed, ascending, or occasionally erect, 1 to 6 dm. long, usually branching; petioles of the lower leaves long, those of the uppermost very short; leaflets cuneate-obovate to cuneate-oblong, obtuse or emarginate, 7 to 30 mm. long, 4 to 12 mm. wide, shallowly denticulate above; stipules ovate, abruptly subulate-setaceous; heads terminal and axillary, solitary or paired, at first ovoid to oblong, becoming cylindrical, 8 to 12 mm.

FIGURE 16.—Rabbitfoot clover (*Trifolium arvense*).
(From Fiori, Iconographia Florae Italicae.)

thick, subtended by the dilated stipules of a pair of opposite leaves; flowers 4 to 6 mm. long, pale-reddish to rose; calyx tube urceolate to ovoid, becoming somewhat inflated, strongly ribbed, pale, villous, the teeth lance-subulate, stiff, erect or spreading in fruit, the lower often nearly equaling the tube and distinctly longer than the upper; corolla equaling or slightly exceeding the calyx, persistent; seeds rounded-ovoid, reddish-brown, minutely foveolate.

Europe and northern Africa to western Asia.

In North America, locally established in fields and along roadsides, from southeastern Massachusetts and New Jersey to Georgia.

16. **Trifolium arvense** L. RABBITFOOT CLOVER. (Fig. 16.)

Trifolium arvense L., Sp. Pl. 769. 1753.

T. gracile Thuill., Fl. Par., ed. 2, 383. 1799.

T. brittingeri Weitenw. ex Opiz, Natural. Tausch. 9: 142. 1825.

T. lagopinum Jord., Pugill. Pl. Nov. 57. 1852.

T. rubellum Jord., Pugill. Pl. Nov. 57. 1852.

T. agrestinum Jord. ex Bor., Fl. Centr. France, ed. 3, 153. 1857.

T. littorale Jord. ex Bor., Fl. Centr. France, ed. 3, 153. 1857.

T. sabuletorum Jord. ex Bor., Fl. Centr. France, ed. 3, 153. 1857.

T. arenivagum Jord. ex Bor., Fl. Centr. France, ed. 3, 157. 1857.

T. longisetum Boiss. & Bal., Diagn. Pl. Orient. 2: 47. 1859.

T. brachyodon (Celak.) Kern., Sched. Fl. Exs. Hung. Austr. 5: 1. 1888.

Short-villous annual; stems spreading, ascending or erect, 0.5 to 4 dm. long, branching or rarely simple; lower and middle leaves short-petioled, the upper nearly sessile;

FIGURE 17.—Berseem clover (*Trifolium alexandrinum*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

leaflets linear-lanceolate or linear-oblong from a cuneate base to oblanceolate, 10 to 25 mm. long, 3 to 10 mm. wide, truncate to acute, shallowly toothed toward the apex or the teeth almost obsolete; lower stipules lanceolate-linear, the upper linear-setiform from an ovate base; peduncles generally short; heads numerous, terminal and axillary, at first semiglobose to ovoid, becoming oblong to short-cylindric, obtuse, 10 to 40 mm. long, 7 to 15 mm. wide, gray or drab; calyx sessile, campanulate, long-villous, the greenish-white tube 10-nerved, the subequal teeth setaceous, plumose, spreading, much longer than the tube and the corolla; corolla very small, pale-rose (white in forma *albiflorum* Sylvén), usually obscured by the hairs of the calyx; pod broadly ovoid; seeds ellipsoid to obovoid, pale-lemon-yellow.

Northern Europe to Ethiopia, Siberia, and the Near East.

Naturalized in North America along dry roadsides and in sterile fields from Quebec and Ontario southward to Florida and from British Columbia southward to Oregon.

17. **Trifolium alexandrinum** L.

BERSEEM CLOVER (EGYPTIAN CLOVER).

(Fig. 17.)

Trifolium alexandrinum L., Cent. Pl. 1: 25. 1755.

Sparingly appressed pubescent annual; stems 3 to 6 dm. long, branching, glabrous or glabrate; petioles of the lower leaves about equaling the leaflets, those of the upper leaves very short; leaflets oblong or broadly elliptic to oblong-lanceolate, obtuse, 1.5 to 5 cm. long, rather shallowly denticulate; stipules lanceolate, the free part subulate to setaceous, villous to bristly-ciliate; heads rather short-peduncled to almost sessile, ovoid, becoming cuneate-oblong, 14 to 20 mm. long, 15 mm. thick; bracts linear, equaling or somewhat exceeding the calyx tube, caducous; calyx sessile, the tube obconic, appressed-hirsute, 2 to 3 mm. long in fruit, the triangular-subulate teeth hirsute, finally spreading, the lower 3 to 4 mm.

FIGURE 18.—Crimson clover (*Trifolium incarnatum*).
(From Hegi, Illustrierte Flora von Mitteleuropa, Carl Hanser Verlag, Munich.)

long, exceeding the tube; corolla yellowish, twice as long as the calyx; pod oblong-ovoid, included, 1-seeded; seed similar to that of red clover but larger, less distinctly lobed.

Egypt and Cyrenaica.

18. **Trifolium incarnatum** L. CRIMSON CLOVER. (Fig. 18.)

Trifolium incarnatum L., Sp. Pl. 769. 1753.

T. molinerii Balb., Cat. Hort. Taur., App. 1: 17. 1813.

T. stramineum Presl, Fl. Sic. 1: 20. 1826.

T. spicatum Perret ex Colla, Herb. Pedem. 2: 128. 1834.

T. noeanum Reichb. ex Mert. & Koch, Deutschl. Fl. 5: 265. 1839.

T. incarnatum var. *elatius* Gibelli & Belli, Mem. Accad. Sci. Torino II, 39: 54. 1889.

Stout, soft-pubescent annual; stems erect, usually simple, occasionally with elongate branches from the base, 2 to 6 dm. long; petioles of the lower and median leaves very long, those of the upper leaves very short; leaflets broadly cuneate-obovate, usually emarginate, 1.5 to 3 cm. long and nearly as wide, strigose, more or less denticulate above; stipules large, the free part short, ovate-obtuse, toothed; heads terminal, solitary, long-peduncled, oblong-conic, becoming cylindrical, 2 to 7 cm. long, 1 to 2.5 cm. thick; calyx fulvous-villous, the tube cylindric to campanulate, strongly 10-ribbed, the teeth linear-setaceous, erect, stiff, spreading in fruit, subequal, more or less exceeding the tube; corolla scarlet or deep-red, exceeding the calyx teeth; pod ovoid; seeds narrowly ovoid, large, greenish-yellow becoming reddish, moderately lustrous.

Western and southern Europe.

In North America, occasionally escaping to waste ground.

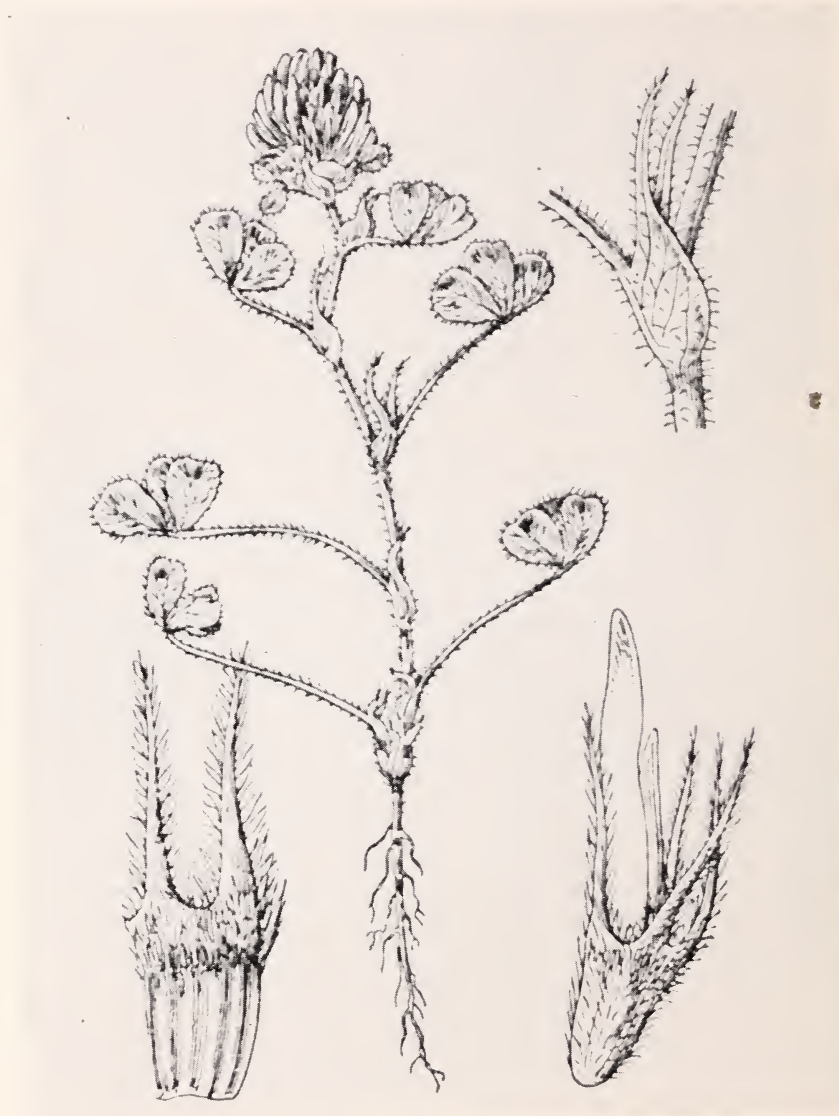

FIGURE 19.—Rose clover (*Trifolium hirtum*).
(From Fiori, Iconographia Florae Italicae.)

19. **Trifolium hirtum** All. ROSE CLOVER. (Fig. 19)

Trifolium hirtum All., Auct. Fl. Pedem. 20. 1789.

T. pictum Roth, Catalect. fasc. 2: 101. 1800.
T. hispidum Desf., Fl. Atlant. 2: 200. 1800.
T. oxypetasum Heldr. & Sart. ex Nym., Consp. 174. 1889.

Copiously villous annual, 1 to 4 dm. high; stems erect or ascending, the branches widely spreading; leaves all petioled or the uppermost sometimes sessile; leaflets obovate or rarely oblong, strongly cuneate, 0.8 to 2 cm. long, the upper shallowly denticulate, the nerves prominent, outwardly curved; stipules (except the broadly ovate-acuminate uppermost one) narrow, abruptly contracted into a long setose tip much longer than the free blade, the united basal portion pale-chartaceous with green or purple ribs, villous; heads terminal, solitary, globose, closely subtended by the uppermost leaf or pair of leaves, their dilated stipules forming an involucre; calyx tube obconic, densely lustrous-villous, about half the length of the subequal, ciliate, setaceous teeth; corolla purplish-red, exceeding the calyx; standard lanceolate-acuminate; lower half of the style united with the stamen tube; pod ovate, 2-valved; seeds rounded-ellipsoid, yellowish, cotyledon margins visible.

Southwestern France to the Mediterranean; Iberian Peninsula; Italy; Balkan Peninsula; Crimea; Caucasus; Asia Minor; Syria; North Africa.

Locally established in eastern United States (Prince Edward County, Va.).

FIGURE 20.—Lappa clover (*Trifolium lappaceum*).
(From Fiori, Iconographia Florae Italicae.)

20. **Trifolium lappaceum** L. LAPPA CLOVER. (Fig. 20.)

Trifolium lappaceum L., Sp. Pl. 768. 1753.

T. nervosum Presl, Fl. Sic. 1: 20. 1826.
T. messanense Tineo ex Lojac., Monogr. Trif. 1878.
T. selinuntinum Tineo ex Nyman, Consp. Suppl. 90. 1889.

Annual, 0.5 to 4 dm. high, erect to spreading or decumbent; stems solitary to numerous, divaricately branching, glabrous or glabrate; leaves, except the uppermost pair, alternate, the lower long-petioled, the upper subsessile; leaflets 0.5 to 2 cm. long, obovate, cuneate, rounded to truncate or emarginate at the apex, shallowly denticulate above, pubescent with rather stiff appressed hairs; free part of stipules lanceolate-acuminate, usually green, hirsute on the lower surface, the united portion pale-chartaceous with purple to green ribs, glabrous; peduncles at first very short, later elongating; heads terminal, solitary, globose to globose-ovoid, at first small, later becoming greatly enlarged and at maturity burlike owing to the spreading calyx teeth; calyx tube short-campanulate, coarsely ribbed, glabrous outside except occasionally for a ring of hairs at the summit, the mouth hairy, the filiform teeth ciliate, greatly broadened and 5-nerved at the base, becoming stiff and widely spreading in fruit; corolla reddish-white, scarcely equaling the calyx; pod ovate; seeds ovoid, light to reddish-brown, moderately lustrous.

Mediterranean France; Iberian Peninsula; Italy; Balkan Peninsula; Crimea; Caucasus; Asia Minor; Iran; North Africa; Canary Islands; Azores; Madeira.

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